indefinite. The Examiner states claim 6 refers to "continuous ribs" that is not mentioned in claim 1. By the accompanying amendment, claim 6 has been amended to recite the "at least one elongated vertical rib" that is recited in claim 1. The objection of claim 9 has been overcome by deleting the phrase objected to. Claim 13 has been cancelled.

The Examiner rejects claims 1-9 and 11-14 under 35 U.S.C. §103(a) as being unpatentable over Willmann et al., and claim 13 as being unpatentable over Grimes et al., for reasons of record. Regarding Willmann, the Examiner states that although Willmann does not explicitly state that the separator has both protuberances and ribs, it would have been obvious to use both to space the separator from the plate.

The present invention pertains to separators for sulphuric acid storage batteries having the form of a pocket which contain positive or negative electrodes. The separators comprise a microporous sheet which is preferably made of synthetic resin such as polyolefin or polyvinyl chloride. By the foregoing amendment, claim 1 has been amended to expressly recite that the microporous sheets are made of synthetic resin. Support for the amendment can be found at page 4, second paragraph of the specification.

The separators of the invention as now claimed exhibit reduced electrical resistance, reduced acid displacement and reduced raw material requirement when compared to separators of the prior art. By the separator profile of the invention, the total volume of ribs and studs can be reduced to about 10 to 30% of the rib volume of ribbed separators according to the prior art without showing the disadvantages of known separators (compare pages 1-3, page 6, first paragraph and page 10, last paragraph of the specification).

Willmann et al. disclose separators which consist of fibrous glass mats comprising a binder for holding the mat in a compressed state (column 5, lines 1-10). Separators comprising a

microporous sheet made of synthetic resin as is now claimed are not disclosed. Indeed, Willmann et al. are concerned with a totally different type of separator.

According to Willmann et al., assembly and acid-filling of batteries containing fibrous separators is more difficult than conventional batteries which do not have compressed fibrous mats between the plates (column 1, lines 48-51), and it is the object of Willmann et al. to provide excellent fibrous mats which permit rapid, uniform filling of batteries with electrolyte as well as ready degassing, cooling and circulation of the electrolyte during pickling and formation of the battery (column 4, lines 31-38).

Willmann et al. suggest the use of separators comprising a mat of randomly orientated resilient fibers and a binder for holding the mat in a stressed state at a predetermined precompressed thickness (column 5, lines 1-10). After assembly and filling of the battery, the binder is degraded to release the resilient fibers from their confinement by the binder so that they can rebound to their unstressed state and cause the separator to tightly engage the electrodes on either side thereof (column 6, lines 32-37).

The mat separators may include a plurality of hemispherical or rib-like protuberance to space the separator from the adjacent electrode and provide flow channels between the separator and the electrodes for facilitating the flow of electrolyte into the electrode/separator stack (column 5, line 60 to column 6, line 11, Figs. 3 and 9). However, as explained above, after assembly and filling of the battery, the binder is degraded to release the resilient fibers from their confinement by the binder, which causes the protuberances to disappear (column 9, lines 44-49 and column 10, lines 18-22, Figs 4 and 10). Thus, when in use, the fibrous separators do not have protuberances; the protuberances are only used to facilitate filling of the battery with electrolyte. After filling, the fibrous layers are in direct contact with the electrode plate, as can be seen, for example, in Figure 10.

In contrast, the polymeric material of the separators of the present invention is not degraded after battery formation, and the studs and ribs of the microporous separators prevent a direct contact of the separator sheet material with the electrodes during the entire life of the battery.

Microporous separators form a totally different class of separators, and the design thereof is determined by completely different requirements. Willmann et al. describe the use of protuberances for facilitating the rapid flow of electrolyte into the electrode/separator, which flow would otherwise by inhibited by the glass mat (column 6, lines 6-11). It is not obvious from Willmann et al. to use a combination of ribs and studs in order to solve a completely different technical problem, namely, providing improved microporous separators with reduced electrical resistance, reduced acid displacement and reduced raw material requirements.

The Examiner rejects claim 13 under 35 U.S.C. §103(a) as being unpatentable over Grimes et al.

By the accompanying amendment, claim 13 has been cancelled.

The amendment to claim 1 is only now being made in order to clearly distinguish Willmann. The amendments to claims 6 and 9 are being made to address the indefinite issues.

Reconsideration and allowance are respectfully requested in view of the foregoing amendment and remarks.

Respectfully submitted,

Kevin S. Lemack
Reg. No. 32,579
176 E. Main Street - Suite 7
Westboro, Massachusetts 01581
TEL: (508) 898-1818

Version with Markings to Show Changes Made

1. (Twice amended) A pocket battery separator for a lead-acid storage battery, said separator comprising a microporous sheet made of synthetic resin having a center area and side areas and being provided with a plurality of studs on at least a first side of the sheet, characterized in that the separator additionally comprises at least one elongated vertical rib in the center area of at least said first side of the sheet provided with a plurality of studs.

6. (Amended) The separator as defined in claim 1 wherein [the continuous ribs have] said at least one elongated vertical rib has the same or a lower height than the studs.

9. (Twice amended) The separator as defined in claim 1 containing an electrode plate being provided with at least one separate rib and comprising a porous sheet being provided with a plurality of studs on at least one side of the sheet [and at least one separate rib applied to the electrode plate].

Replacement Sheet

1. (Twice amended) A pocket battery separator for a lead-acid storage battery, said separator comprising a microporous sheet made of synthetic resin having a center area and side areas and being provided with a plurality of studs on at least a first side of the sheet, characterized in that the separator additionally comprises at least one elongated vertical rib in the center area of at least said first side of the sheet provided with a plurality of studs.

6. (Amended) The separator as defined in claim 1 wherein said at least one elongated vertical rib has the same or a lower height than the studs.

9. (Twice amended) The separator as defined in claim 1 containing an electrode plate being provided with at least one separate rib and comprising a porous sheet being provided with a plurality of studs on at least one side of the sheet.